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ABSTRACT

This paper explores the progress public broadcasting (originally called "educational television") has made in taking advantage of a relatively new application of technology: digital information services. How public broadcasters have pursued this technology and how it may become an integral part of the future of public broadcasting are reviewed. Three of the more successful digital information services that have been provided by public broadcasters (i.e., closed captioning, electronic bulletin board services, and electronic text) are discussed. The paper then discusses three areas that are currently being pursued: digital radio broadcasting, interactive video data services, and the broadcasting of data over the vertical blanking interval (VBI) of public television stations. A vision for the future of public broadcasting is considered, identifying some of the important opportunities that should be taken advantage of before the rapidly changing technological environment eclipses public broadcasting's chance to define a better future for an electronic society. (Contains 39 references.) (RS)

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A paper presented to the International Communication Association, Miami, Florida, May 1992

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Introduction

It may be an understatement to say that public service broadcasting in the United States has had a difficult time defining what it is. It is much easier to define it in terms of what it is not—broadcasting that is not commercial, or "noncommercial." The Carnegie Commission suggested the more positive modifier "public," yet this has done little to relieve the identity crisis; some have suggested that it has aggravated it (Crotts & Rowland, 1981; Rowland, 1986b). Other than not being commercial, the answer to the question "What is public broadcasting?" depends to a great extent on when the question is asked, and of whom.

Originally, educational programming (or more precisely, instructional programming) was a key distinction. The "noncommercial educational" label is still the preferred term of the Federal Communications Commission, yet this designation seems increasingly inadequate. Although there are exceptions, public broadcasters have adopted many of the strategies of their commercial counterparts, while distancing themselves from an educational mission. Tune in to public television, and you are likely to find amid the otherwise outstanding programs a noticeable trend toward commercial "hits" like *The Prisoner* and *The Lawrence Welk Show*, college football games, aerobic exercise programs, and "classic" films like *Herbie Rides Again*. While such programming undoubtedly helps public television reach a larger audience, and therefore expands its potential funding base, it makes the prophetic vision articulated by the Carnegie Commission (1967), of an alternative broadcast service "free from the constraints, however necessary in their context, of commercial television" (p. 99), seem strangely remote, outdated and naive. The Carnegie Commission did much to rally public broadcasters around the themes of localism, diversity and excellence. While the value of promoting such goals may be substantial, especially in light of the continuing need for federal financing, these glittering generalities have provided only a sketchy definition of what public broadcasting is—or should be.

What may be even less clear is where public broadcasting is going. Willard Rowland (1986a) has not been one to mince words about this persistent myopia:

> If public broadcasting is ever to be more than a relatively minor gap-filler in America's overwhelmingly commercial telecommunications industry, it needs to define its destiny. As long as public broadcasting continues to have difficulty looking ahead comprehensively and systematically, it will not become the public service force in American cultural and political life that its most genuine supporters expect it to be. (p. 13)

What do these "most genuine supporters" expect public broadcasting to be? Again, it depends on whom you ask, but a common theme is the embracing of communication technologies for the public good, of using the fruit of technological innovation not for the enrichment of commercial interests, but for the enrichment of human minds.

Included as part of the Carnegie Commission's first report on educational television was a paper by J. C. R. Licklider (1967), who wrote of "televistas," futuristic visions of what public broadcasting could become, "possibilities that come to mind when one deliberately looks aside from the central line of thought about educational television and rejects the assumption that educational applications have to be built upon the framework of conventional broadcast television" (p. 201). Five years later, Frank Korman (1972) asserted that public broadcasters "may be on the verge of a new threshold in successful application of telecommunications technology" (pp. 322-323), and predicted the development of "learner-instruction interaction" in public television programs (p. 324) and public radio subcarrier transmission of "electrowriter" services (p. 329). After the Carnegie Commission (1979) readdressed itself to public broadcasting, it was "convinced that public broadcasting must strengthen its ability to operate on the frontiers of new technology if it is to fully serve the American people" and recommended a "stronger, ongoing, and more fully integrated research and development capability to assist the system in taking advantage of new technology to meet public needs" (p. 243). More recently, James Fellows (1990) urged public broadcasters to take advantage of their "unique position" in the evolving mix of communication technologies:

> The local, state and national public television systems are in a unique position. No other institution in America provides such a suitable nucleus for exploiting the information, video and communications technology already on the scene, which is expanding its reach and economies at astonishingly rapid rates (p. 39).

Today, a quarter of a century after the first Carnegie Commission report and the Public Broadcasting Act of 1967, it seems an appropriate time to assess the progress of public broadcasting to date, and to consider the "televistas" that may lie ahead. Has noncommercial broadcasting posi-

tioned itself on the frontiers of new technology? In what ways has it taken advantage of new technology to meet public needs? What has motivated its development of new technologies? How has it contributed to charting the future of America's communication environment? The answers to these questions may contribute to a better understanding of where public broadcasting has been, and where it may be headed. It may even help satisfy the need for a clearer definition of the role of public broadcasting in contemporary American society.

This paper is an exploration into the progress public broadcasting has made in taking advantage of one of the new technologies, or more precisely, a relatively new application of technology: digital information services. Traditional broadcast services transmit aural and visual information in a form directly interpretable through human senses, but today an increasing amount of radio frequency spectrum is being used for the transmission of digital information, necessitating an additional mediating layer of computers or computer-driven devices before such data can be made intelligible to a human audience. This paper offers both a review of how public broadcasters have pursued this technology, and a preview of how it may become an integral part of the future of public broadcasting. First is an exploration of *what's been done*, a discussion of three of the more successful digital information services that have been provided by public broadcasters. This is followed by a look at *what's being done*, some of the projects currently being developed that should become reality in the near future. The paper concludes with an argument for *what could be done*, a vision for the future of public broadcasting, identifying some of the important opportunities the author feels should be taken advantage of, preferably soon—before the rapidly changing technological environment eclipses public broadcasting's chance to define a better future for our electronic society.

What's Been Done

Although those outside of the industry may be unaware of the extent of involvement by public broadcasters in digital information services, significant contributions have been made in at least three areas: closed captioning, electronic bulletin board services, and electronic text. Illustrating the progress made by public broadcasting in these areas are The Caption Center, Learning Link, and the Electronic Text Consortium.

Closed Captioning: The Caption Center

Perhaps the first digital information service provided by public broadcasters, and arguably the most successful, is closed captioning. Although closed captioning is today available on commercial network programs, cable television channels, and prerecorded video cassettes, public broadcasters have played an important role in the development of this technology. In fact, public broadcasting pioneered the first applications of television captioning in this country. In 1970, when Dr. Malcolm Norwood of the U.S. Department of Health, Education and Welfare was considering the best way to fund development of captioning technology, he went first to public broadcaster WGBH in Boston, "because of its reputation as an innovator" (Loeterman, 1989). Within a year, the world's first television captioning agency, The Caption Center, was founded by the WGBH Educational Foundation.

During the 1970s, much of the development work in captioning was done by The Caption Center. It produced the first nationally broadcast captioned program, Julia Child's *The French Chef*, which aired on PBS in the summer of 1971. On January 20, 1973, a team of captioners captioned President Nixon's 22-minute inaugural address in record time—only five hours; it was aired that evening on PBS. The success of that venture encouraged Phil Collyer, the Caption Center's first director, to approach ABC with the idea of producing a captioned version of "The ABC Evening News." On December 3, 1973, the Eastern Educational Network began distributing to public television stations "The Captioned ABC News."[1]

It should be pointed out that all of these early efforts were "open captioned," meaning that the captions were part of the television picture, appearing on screen without the use of special decoders. During the late 1970s, PBS began developing "line 21 closed captioning," the method of transmission in wide use today. Digital binary data is inserted into line 21 of a television signal's vertical blanking interval—a portion of the television signal that is not part of the television picture, but is used to "blank out" the electron beam during the retrace period between the sequential television picture fields. Public broadcasting was thus significantly involved in one of the first widespread applications of a broadcast digital information service; for this pioneering work, PBS Engineering received an Emmy Award (Adeyeye & Richer, 1988).

Although The Caption Center worked with PBS in the development of line 21 closed captioning, the rights to the technology were given to a separate organization outside of public broadcasting, the National Captioning Institute (NCI). NCI began closed-captioned television service on March 16, 1980, with a weekly schedule of 16 hours of programs on ABC, NBC and PBS. Recognizing that open captioning would soon become obsolete, The Caption Center developed its own line 21 captioning system, improving upon the system PBS licensed to NCI. Working together with the CBS teletext project in the early 1980s, The Caption Center developed "dual-mode captions," combining teletext technology with line-21 captioning. The Caption Center

[1] Because coverage of the Watergate hearings was occupying the late night time slot on PBS, nationwide distribution was delayed until August 5, 1974, three days before President Nixon resigned from office.

also developed a special software system, "CC Writer," that made the captioning process simpler and faster. In 1986, The Caption Center began producing the first closed-captioned local television newscasts, including the WGBH "Ten O'clock News." Recently, The Caption Center has developed the Descriptive Video Service (DVS) for the visually impaired community, which takes advantage of the Second Audio Program (SAP) capability of television signals to transmit spoken descriptions of on-screen action. And the Caption Center was a significant part of the lobbying effort leading to the passage of the Television Decoder Circuitry Act of 1990 (Public Law 101-431), which requires television manufacturers to include built-in closed-caption decoders in television sets (with screens 13" or larger) beginning in July, 1993.

The Caption Center continues to be a non-profit service of the WGBH Educational Foundation. Remaining true to the spirit of noncommercial, public service broadcasting, none of the technology it has developed is proprietary. Dan Glisson, the engineer who developed The Caption Center's line-21 closed-captioning system, notes that "The Caption Center has always shared technical and other information with anyone who has wanted it" (Loeterman, 1989). Although today closed-caption technology is widely used by both commercial and noncommercial broadcasters, much of the credit for its development is due to the work of public broadcasting efforts like The Caption Center.

Electronic Bulletin Boards: Learning Link

An electronic bulletin board is a computer-based electronic mail and information service that is usually accessed via telephone modem connection. Electronic bulletin boards are often operated on a noncommercial basis, with information of interest to a specific, rather than a general, audience. The first electronic bulletin board was established in Chicago in 1978; by 1986 their number had grown to 2500 (Chesebro & Bonsall, 1989). Because electronic bulletin boards are fairly inexpensive to start and maintain, many broadcasters have experimented with using them for promotional and/or public service purposes. One of the more successful efforts by public broadcasters to provide an electronic bulletin board service is Learning Link.

Started in October, 1985 at WNET in New York, Learning Link is targeted primarily to elementary and secondary school teachers and students, but is also used by school administrators, adult learners and public television viewers. With a computer, modem, telephone line and telecommunications software, users can go "on line" with Learning Link, accessing a variety of information. Originally, the bulletin board offered services in five areas: (1) program information for WNET's television schedule, (2) discussion forums for teachers and other Learning Link users, (3) gateways to other on-line services and databases through the EDISON system, (4) electronic mail capabilities for subscribers, and (5) an on-line catalogue of educational products and resources. For the most part, Learning Link continues to offer these and similar services, but today the service has expanded to offer support for a number of local Learning Link bulletin boards, as well as a national service.

Local Learning Link systems are operated by public television stations, state public broadcasting networks and, in some cases, by state departments of education in cooperation with local public broadcasters. Currently, there are thirteen local Learning Link systems in operation, forming the Learning Link National Consortium. By combining resources, together these systems maintain the "core content" of Learning Link, which currently consists of over 6,000 computer screens of information (Learning Link, 1991). Each system operator customizes this core content to meet the needs of the local community, often adding program schedules, learning guides and curricular support for local public television programs. In those communities without a local Learning Link service, users may access IntroLink, a national service based primarily on the core content maintained by the Learning Link National Consortium.

In 1990, the Central Educational Network assumed management of the Learning Link National Consortium through LinkNet, a subsidiary created for this purpose (Singer, 1990). Out of its Des Plaines, Illinois offices, LinkNet manages the IntroLink national service, maintains a training and marketing program for local Learning Link services, and provides much of the core content of those services. LinkNet also negotiates relationships with database vendors and information providers on behalf of the local systems; many of these "value adding" services are offered through Einstein, a database "gateway." Through the Einstein gateway, Learning Link users can access nearly 90 different on-line digital information services, including the *Educational Resources Information Center* (ERIC) database, the *Education Index*, the *Book Review Digest*, the *General Science Index*, and the *National College Databank*.

Although Learning Link does not make use of public broadcasting's airwaves, in many respects this bulletin board service has become integrated into the American system of public broadcasting. On both the national and local level, public broadcasters are involved in maintaining the service and creating much of its content. The emphasis on local control and community service is consonant with public broadcasting's traditions of localism. The educational value of Learning Link has served to reinforce public broadcasting's commitment to broad educational objectives. And Learning Link has helped public broadcasting take greater advantage of new technology. As executive Director Robert Spielvogel (1988) notes, Learning Link was designed to meet "a growing need to position educational television within a context of learning technologies in general" (p. 169).

Electronic Text: The Electronic Text Consortium

Electronic text is a term that has been used to describe consumer information services that use over-the-air broadcast (teletext), cable (cabletext) or telephone line (videotext)[2] transmission methods (Carey & Moss, 1984). Electronic text services did not develop in this country as quickly as they did in Europe, where the French Minitel system is perhaps the most successful venture (Gayeski & Williams, 1985). During the early 1980s, a number of public television stations experimented with teletext, included KCET in Los Angeles, WETA in Washington, D.C., and WGBH in Boston (Carey & Moss, 1984). A significant contribution to the development of electronic text in this country was made in 1983, when the Annenberg/CPB Project funded a major research effort into the use of electronic text in higher education. Most of this research was conducted at public television stations WGBH in Boston, WHA in Wisconsin, and KUON in Lincoln, which together with the Center for Communications at San Diego State University and the Universities of Nebraska and Wisconsin formed the Electronic Text Consortium.[3]

The purpose of the Electronic Text Consortium was "to develop and test a variety of electronic text services and to assess which configurations of content and means of delivery, if any, make sense for higher education" (Carey & Dozier, 1985, p. 1). Among the services the Consortium explored were interactive cable and videotext offerings designed to supplement instructional television programs (telecourses) broadcast over public television stations. To evaluate the potential of these services for higher education, a variety of laboratory, field and survey studies were conducted, addressing issues such as the effectiveness of electronic text as a learning tool, its attractiveness to students, and potential barriers to its adoption.

For the most part, the results were quite positive. Students who used electronic text as a supplement for instructional telecourses had significantly higher test scores than students who did not make use of electronic text. Surveys of students found a general readiness to use electronic text services, especially to the extent they met specific needs for self-paced learning and distance learning. Survey research also revealed that a possible barrier to adoption of electronic text was faculty resistance: while "a few faculty seemed to believe that electronic text might replace their job," a strategy of "describing it simply as another tool for student and instructors appeared to receive positive reactions" (Carey & Dozier, 1985, p. 8). On the basis of their research, the Consortium concluded with a "positive assessment of electronic text as a tool for higher education" (Carey & Dozier, 1985, p. 9).

Because of the pioneering work of the Electronic Text Consortium and similar efforts, public broadcasters were in a better position to evaluate the opportunities provided by electronic text services. Carey & Moss (1984) identified three reasons why electronic text should interest public broadcasters: (1) a number of trained personnel at public television stations with experience in electronic text technology, (2) research showing wide consumer acceptance, and (3) the value of electronic text as a means to attract new viewers to public broadcasting (p. 43). They argued for "a careful, systematic entry by public broadcasting into electronic text" (p. 43). Some public broadcasters have already attempted to take full advantage of electronic text, including one of the Consortium stations, KUON, whose AgSat interactive telecourse program has been quite successful. On a national level, the public broadcasting community may be preparing to exploit this opportunity more fully, in the form of digital data broadcasting, one of the topics addressed in the next section of this paper.

What's Being Done

As the previous examples have illustrated, public broadcasting has made significant progress in developing practical applications of digital information technologies. Yet this progress may be just a prologue to an even greater commitment to not be left behind in the changing communications environment. Research into how best to integrate new technologies into the public broadcasting enterprise is an ongoing effort, and three areas that are currently being pursued are digital radio broadcasting, interactive video data services, and the broadcasting of data over the vertical blanking interval (VBI) of public television stations.

Digital Radio Broadcasting

During the 1990s, radio broadcasting will likely be transformed into a substantially different broadcast service with the introduction of digital radio broadcasting technology. Digital radio should not be confused with the broadcasting of music on digitally recorded compact discs (CD) or digital audio tape (DAT), which today is widely accomplished using conventional AM and FM analog broadcast transmission methods. While digital radio will be able to transmit digitally encoded audio with much greater precision than traditional methods, it will offer much more to the listener than just improved sound. Digital radio represents a major change in how radio signals are transmitted and received, and will require an investment in new transmitters, spectrum space and radio receivers.

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[2] Some authors prefer the term "videotex" (without a final 't') to refer to cable or telephone line transmission of electronic text services. (See Dordick, 1986, chapter 11).

[3] KPBS in San Diego was indirectly involved in this project through the Center for Communications at San Diego State. Although not officially part of the Electronic Text Consortium, a similar research effort funded by the Annenberg/CPB project was conducted by the University of South Florida and public broadcaster WUFT in Gainsville (Open University, 1987).

That investment will be made for at least two reasons. Digital radio offers the listener a significantly higher level of sonic quality, of particular interest to upscale audiophiles that are typically well-represented in public radio audiences. Perhaps more importantly, digital radio greatly expands the signal carrying capacity of radio. Because of advanced signal compression methods, it is now possible to transmit up to four channels of compact disc quality stereo programming in the same spectrum space occupied by a traditional FM station (Starling, 1991). Some of this additional signal carrying capacity will be used to transmit digital information, providing listeners with a variety of customized services.

For a better idea of the potential of digital radio for public broadcasting, consider this futuristic vision offered by Mike Starling (1991):

> It's 6:12 a.m. As a commuter slips behind the wheel, the car radio begins delivering the latest news transmitted at the top of the hour by the local public radio station. Next, the optomagnetic disc plays a customized program tailored for the commute, starting with a reminder about today's office schedule, delivered by a synthesized announcer. Traffic information keyed to the roads of travel is given next, followed by Supreme Court updates (the listener is a lawyer) and yesterday's commentaries by the BBC's Alistair Cooke, followed by NPR's Red Barber...The radio could even display the following message: "Hi Jan! Happy Birthday! Thanks for your continuing support. We'll upload the new Stravinsky's "Firebird" from Sydney tonight—our birthday present to you. Your friends at WPUB-FM."

The technology for making such a vision a reality has already been developed, and widespread implementation may occur before the end of this decade. The question for public radio broadcasters is not so much *if* they should take advantage of digital radio, but *how* they will take advantage of it. Public radio at both the national and local level is developing digital radio implementation strategies, so as not to be left behind in the commercial radio industry's rush to embrace this technology.

Toward that end, the Corporation for Public Broadcasting has set aside $350,000 of its 1992 budget for the "CPB New Technologies Project," with most of that money funding studies of digital radio. According to station consultant Tom Thomas, this investment is "a very on-track effort," and "CPB should and probably ultimately will spend quite a bit more on the subject" (Cronin, 1991a). National Public Radio is actively involved with the "Committee for Digital Radio Broadcasting," a group that also includes representatives of commercial broadcasters Capital Cities/ABC, CBS and Gannett Radio (Barbieri, 1990a). And when the Federal Communications Commission issued a notice of inquiry into digital radio on November 13, 1990, a broad alliance of public radio organizations[4] strongly advocated a plan to reserve for noncommercial licensees 20 percent of the spectrum space that will eventually be allocated for digital radio (Barbieri, 1990b).

The next few years may be critical ones for public radio, as it develops strategies for maintaining a place in the new radio environment. As Thomas (1991) points out:

> Public radio stations will confront a host of programming implications that flow from these technological changes. What unique and compelling services can they offer? How will local services compete against the economic efficiencies and power of national program streams?...Will there be a meaningful distinction between "local" and "national" in the minds of most listeners as these scenarios unfold? Will any such distinctions be important enough to warrant sustaining the full complement of public radio stations now in operation? (p. 33)

These and others questions will challenge public radio to reassert its mandate in a rapidly changing technological environment. A similar challenge may be facing public television in the form of a new service now being considered.

Interactive Video Data Services

In December, 1987, the Federal Communications Commission received a Petition for Rule Making (RM 6196) from TV Answer, Inc., a small, enterprising company started by Fernando Morales, a Mexican broadcast engineer. The petition proposed a new broadcast service, the Interactive Video Data Service (IVDS), that would allow consumers to purchase and operate low-power data transmitters to engage in a variety of interactive television services, such as executing electronic banking transactions, making purchases, accessing databases, participating in game shows, and responding to instructional programming. In March, 1991, the FCC issued a Notice of Proposed Rule Making that would establish such a service in the 218 MHz band (just slightly higher in frequency than the present VHF channel 13). When final FCC action on this new service is announced, a new industry will be born, one that has the potential to substantially change the way people use their television sets.

The proposed IVDS system will operate much like a cellular phone system. An IVDS-equipped television will have a small 218 MHz transceiver, sending digital signals to and receiving them from "cell sites." Each cell site will be able to serve an area of about 10,000 homes. A small two-way satellite dish called a VSAT (very small aperture terminal) will be used to exchange data between the

[4] Groups responding to the notice of inquiry included National Public Radio, the Corporation for Public Broadcasting, the National Federation of Community Broadcasters, Rocky Mountain Public Radio and the Intercollegiate Broadcasting System.

cell sites and a central computer. Thus, there are two primary communication "loops" in the IVDS system, one loop between the home units and the cell sites (using low-power transmitters in the 218 MHz band), and a second loop between the cell sites and the IVDS vendor's headquarters (using Ku-band satellite transmission). Strictly speaking, a third loop will exist in most IVDS applications, as viewers at home will use remote-control devices to make selections from menus appearing on the television screen.

Edward Coltman, Director of Policy Development and Planning for the Corporation for Public Broadcasting, says the CPB may soon commission research into the potential of IVDS for public television (Behrens, 1991). One application would likely be interactive telecourses, where students could respond to multiple choice questions and receive instant feedback. Because IVDS will enable channels to be selected in customizable menus, another plus for public television will be the ability of viewers to more easily tune in public television stations that are now in relatively undesirable locations in the UHF band. Development directors will appreciate the ability for public television viewers to respond immediately to fund raising drives; with just a flick of a remote-control joystick, a generous viewer could instantly move money from his or her checking account directly into the local public television station's coffers.

It is still unclear the extent to which public broadcasting will take advantage of this new use of radio frequencies. WGBH is planning to experiment with an interactive version of a new PBS series, *Where in the World is Carmen San Diego?* (Behrens, 1991), but this venture will use data transmission over FM subcarriers rather than the proposed IVDS service. And the CPB has recently committed $950,000 to help fund a joint CPB/PBS project aimed at developing software that will enable public television stations to deliver interactive programming (Cronin, 1991b), but so far this effort has been aimed at using VSATs rather than IVDS receivers. The FCC noted several times in its Notice of Proposed Rulemaking the potential application of IVDS for educational programming; so far the responses from public broadcasters have been cautiously positive. Said George Hall, former head of public television's Office of New Technology Initiatives, "It's a good thing, but there's no reason to stand back in awe" (Singer, 1991).

Perhaps the failures of teletext and interactive cable to gain widespread acceptance are too fresh in the memories of public broadcasters; despite this, one industry forecaster predicts that IVDS will penetrate 43% of all television households within ten years, reaching approximately 40 million subscribers by the year 2002 (Bain and Company, 1991). Although industry estimates may offer tenuous evidence for public broadcasting's involvement in IVDS, what should not be ignored is the FCC proposal that each television market have two IVDS services, rather than the exclusive plan proposed by TV Answer. If public broadcasters act now, perhaps the FCC might adopt a preference policy for noncommercial IVDS applications, or even reserve one of the IVDS channels for noncommercial licensees. Given the FCC's emphasis on the educational value of IVDS in its rationale for the proposed service, it is not inconceivable that the potential exists for noncommercial broadcasting to have an unprecedented 50/50 split of this spectrum space with commercial interests, but this isn't likely to happen if public broadcasters don't take the initiative.

VBI Data Broadcasting

Since 1981, the Public Broadcasting Service has used part of the vertical blanking interval (VBI) of its satellite distributed television programming for sending data to member stations; this service is widely known as DACS, an acronym for Direct Access Communications.[5] In 1983, PBS began investigating the use of the VBI for commercial data distribution, as a method of raising revenue for public television (Garr and Richer, 1990). Today, as a result of research and development by PBS Engineering, and aggressive marketing by PBS Enterprises (the for-profit subsidiary of PBS), the VBI data transmission system known as the PBS National Datacast is a reality.

PBS National Datacast has developed, or is in the process of developing a broad range of services that make use of VBI data transmission, including:

Vericast. In 1988, PBS National Datacast started working on a joint venture with VISA, the world's largest credit card organization, and VeriFone, a leading vender of point-of-sale credit card authorization equipment. In September, 1990, PBS National Datacast unveiled Vericast, a credit card authorization system that uses VBI data transmission to greatly speed up the process of approving credit card purchases. Every day, VISA transmits to PBS the latest version of their "hot card" file. This file is then encoded into the VBI of PBS satellite-delivered programming, which in turn is broadcast by local public television stations. A participating local merchant receives this "hot card" file using a specially designed VBI data receiver, which stores the file in its memory. When a cashier rings up a VISA credit card transaction, the point-of-sale computer/cash register compares the customer's credit card number with the "hot card" list, and within seconds the credit sale is verified.

The Education Pipeline. PBS National Datacast is preparing to begin using VBI data transmission to distribute a variety of educational resources to schools and colleges under a program called the Education Pipeline. Teacher's guides,

[5] Originally, when PBS used telephone lines to connect with terminals at member stations, DACS stood for Dial Access Communications. Rather than create a new acronym when DACS data was switched over to satellite distribution, the word "direct" was simply substituted for "dial," allowing the familiar acronym to survive. See Adeyeye and Richer, 1988, p. 470.

student workbooks, computer software, bibliographies, research databases, and other materials of instructional value could be downloaded by schools with VBI data receivers connected to personal computers. An initial test phase of this service is already underway, and national distribution is scheduled to begin sometime in the next two years (Garr & Richer, 1990).

Video Indexing. A service already being offered, called Video Indexing, uses the VBI to transmit an index of "electronic markers" with instructional public television programs. Using a computer and a video cassette recorder, a student can quickly cue up a program segment referenced by an instructional guide or computer program. For example, a music student could use this system to learn the meaning of arpeggio: the student reads the description in a textbook, sees an illustration on a computer screen, and hears an example on a video tape of *Great Performances*, automatically cued up to just the right spot.

Insight Telecast. Despite the wide acceptance of video cassette recorders, many people still have difficulty programming a VCR to record a television program. A device now being test marketed will make this process much simpler, by allowing VCR owners to simply choose the program they want to record from an on-screen program listing. Program listings, tailored for each local TV market, will be transmitted using the VBI of public television stations. Instead of entering a complex sequence of dates, start times, end times, and channel numbers, a VCR owner will simply select the program he or she wishes to record from a menu appearing on the television screen.

Dataspeed Stock Quotes. The VBI is being developed as a method for transmitting up-to-the-minute stock, bond and commodity market quotations. Although similar services have been developed using FM subcarrier technology, the VBI system developed by PBS Engineering has significant advantages, including advanced error correction and larger data handling capacity (Garr & Richer, 1990). The data is already being transmitted by PBS National Datacast, and the special VBI receivers are currently being test marketed by the Dataspeed Stock Quote Service in the Sacramento and San Francisco areas (Behrens, 1991).

These services are just a few of the opportunities being pursued by PBS National Datacast. Other pilot projects include the use of VBI transmission for the distribution of medical and federal procurement information, specialized news services, electronic banking transactions, and even as a source of advertising revenue. In the words of one PBS promotional piece, "PBS engineers have found a rich lode of possibilities" in VBI data transmission ("Much more," 1990, p. 42). But before public broadcasting strip-mines that lode, it may be helpful to look past the short-term benefits, and look further down the road, at some issues of long-term consequence.

What Could Be Done

This paper began by considering the difficulties public broadcasting has had in defining what it is, and what it should strive to be. Attempts to resolve these basic issues have consumed much of the energy, time and passion of this nation's public broadcasting community. It is unlikely that any one paper could contribute more than a ripple in the tumultuous seas that have shaped, for better or for worse, the character of public broadcasting during the past twenty-five years. Yet in an effort to apply what has been learned from public broadcasting's involvement with digital information services, this paper concludes by presenting a case for what could be done to carry the spirit of public service into a rapidly changing communications environment. What follows is a "televista," a vision of what public broadcasting could, and perhaps should, strive to become.

During the early 1960s, when television was bringing fundamental changes to the way people communicate, Marshall McLuhan (1964) popularized the notion of a "global village," a vision of a shrinking world, one so "electronically contracted, the globe is no more than a village" (p. 20). During the late 1970s, with the development of computer telecommunication networks, Hiltz and Turoff (1978) issued a similar McLuhanesque speculation:

> We will become the Network Nation, exchanging vast amounts of both information and socio-emotional communications with colleagues, friends and 'strangers' who share similar interests, who are spread out all over the nation. Ultimately, ... we will become a 'global village' whose boundaries are demarcated only by the political decisions of those governments that choose not to become part of an international computer network. (p. xxix)

Today, digital telecommunication services are rapidly bringing that vision of the future into fruition. The proliferation of electronic data interchange systems has already brought significant changes to the business community, where a growing percentage of financial transactions are now conducted by computers "talking with each other" (Kimberley, 1991). Modern libraries are moving away from the acquisition of books and periodicals, and moving toward providing patrons with access to a variety of computerized information services (LaComb, 1976; Drake, 1980). And with the growth of consumer digital information services, such as CompuServe and Prodigy—services designed to appeal to the general public—it may be only a matter of time before the computer becomes as prevalent a communication medium in the American home as the radio and the television set. The computer or, to be more specific, the computer connected to other computers via telecommunication networks, may well represent as significant a quantum leap in mediated communication

as television appeared to be to McLuhan nearly thirty years ago.

It was also during the 1960s when a distinctive dichotomy was evolving between commercial and noncommercial interests in the use of television. The commercial broadcasting industry brought to television its experiences in commercial radio; in many respects, commercial television stole the mass audience programming philosophies and techniques developed by radio, forcing the older medium to innovate "narrowcasting" techniques in order to survive as a viable communication medium. Those involved in noncommercial television, however, did not have the benefit of having a successful older medium to imitate; noncommercial radio got off to a rocky start in this country, and by the early 1960s was still too underdeveloped and amorphous to offer much of a guiding light for noncommercial television. Lacking any proven formulas for success, and inspired to dream big by the visions of prophets like McLuhan, the leaders of noncommercial television during this era developed a common sense of mission; they saw in public television the potential for the ultimate realization of democracy, for making available to the general public the best thinking of our brightest minds, for bringing to the culture-starved masses television programming of significant worth and lasting value. It was the right dream at the right time: with amazing swiftness, the Carnegie Commission articulated it, the Congress made it law, the President gave it his support, and by the end of the decade a new communication medium was born.

A similar crossroads may be fast approaching. Most of the digital information services now being provided are commercial in nature, charging subscribers by the month or by the minute; some even sell advertising space to generate additional revenue. But there are a smaller, yet growing number of noncommercial information services, such as BITNET, the Cleveland FreeNet, and the Boston Community Information System (Gifford, 1990). Today these noncommercial services, like their counterparts in noncommercial television thirty years ago, are struggling to create an alternative to the commercial digital information industry. They are laying the groundwork for a system of "public data access," where digital information is accessible to all, and where technology is used not for the enrichment of commercial interests, but for the enrichment of human minds.

And this time the developing noncommercial medium has a successful older sibling to emulate. Public broadcasting has blazed a path through the thick forest of commercial interests and government intervention, and has survived, albeit with a few scars. The success of public broadcasting can serve as a model, and its failures can help chart a safer course for this infant system of public digital information services. Although it will likely be difficult, if action is taken soon, it may even be possible to situate this noncommercial medium on nearly equal footing with the commercial services. This is a most important opportunity, not unlike that envisioned by the Carnegie Commission a quarter century ago—a chance to contribute to a better future for our electronic society.

Public broadcasters have an opportunity to be a part of that future, and there is some evidence that they will be. This paper has shown a willingness, if not an eagerness, on the part of many public broadcasters to embrace new technologies for the public good. Yet while some public broadcasters have seen the digital information services discussed in this paper as opportunities to make vital public service contributions to a changing communications environment, others have seen them as merely auxiliary services, hi-tech "add-ons" to the primary business of providing public television and radio programming.

Furthermore, some of the digital information services provided by public broadcasters have been a result of commercial, rather than noncommercial motives. The marketing of public television station VBI or public radio subcarrier space to commercial interests may seem like an innocent way to help underwrite public service broadcasting. After all, public broadcasting has historically used many different approaches to help pay the bills, and exploiting the essentially unused portions of broadcast signals may seem a relatively benign way to generate revenue. Most public broadcasters would agree that such capitalistic ventures should not be allowed to corrupt the fundamental character of noncommercial broadcasting.

Yet what will happen when broadcasting is no longer a central aspect of noncommercial telecommunications? How will these early commercial applications of digital information services influence public broadcasting's broader development of such services in the public interest? Will public broadcasting be a credible player in the evolution of noncommercial digital information services if it has already sullied the waters with commercial ventures? At first glance, this may seem to be overstating the case, but turn the tables for a moment: would making money from commercial television and radio operations be an appropriate way for public telecommunications to fund noncommercial digital information services?

It is conceivable that the comfort threshold for commercial enterprises on the part of noncommercial broadcasters has gradually risen over the past quarter century. If so, consider the implications of this trend on the fiber of American public broadcasting. Has the increasing preoccupation with the business of public broadcasting substantially altered the noncommercial character of public broadcasting? During the late 1960s and early 1970s, when the public broadcasting community was young and vibrant, there was a strong sense of purpose, a dedication to ideals, a passion for public service. Is that passion still there today?

Perhaps it's still there, but latent—waiting for a catalyst to reassert the original mission of public broadcasting: a dedication to use technology for public service, not a commitment to the survival of technological infrastructure. The opportunity to be a part of a new noncommercial digital information service may be that catalyst, a stimulus to turn away from a self-defensive focus on broadcasting, and back to a selfless emphasis on "the public." The flame of public service may still be burning in the public broadcasting community, but without new sources of fuel its brilliance will surely fade; a concerted effort to be part of a noncommercial alternative to the commercial digital information industry might be just what's needed to fan the fire back to a blaze.

This, then, is what public broadcasting could do. It could lay the foundation for a system of public information access—a public information utility. It could prepare for the day when most people will get most information not through mass communication channels, but through computer-mediated channels that combine digital information with digital audio and video. It could invest in new technology, not with an eye toward developing auxiliary services to broadcasting, but with the realization that broadcasting itself will soon be seen as an auxiliary service to more efficient means of delivery. If public broadcasting is to survive the next quarter century, it will not be in the carcass of an outmoded broadcast technology. It will be in a new form, a telecommunication service using a variety of transmission technologies, designed to benefit those not served by commercial interests, and made available to all.

George Hall (1990) has articulated this future in the idea of "teleplex," a term loosely adopted from "public telecommunications center complex." He is convinced that some form of teleplex will begin to be seen in the next few years, and he warns (Hall, 1991) that it will happen with or without the help of public broadcasters:

> If public broadcasters don't move toward teleplexing, and many of them don't seem remotely interested in the idea yet, then frankly, I think they'll disappear. But if public broadcasters have the imagination, and the energy, and the courage to move toward serving people on demand, and doing those things which get them out of the old familiar broadcasting rut, then I think they not only have a chance to survive, but a chance to help build a wonderful new information institution in this county. If they don't do it, others will, and they will just simply disappear.

The early development of digital information services by public broadcasting has shown that is has recognized an opportunity to be part of the future telecommunications environment. It can only be hoped that public broadcasting will move quickly to take advantage of this opportunity, while it still has a future.

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